Claims

[c1] 1.A digitally controlled sensor system comprising:

a sensor;

an analog front end module coupled to the sensor and configured to produce an analog sensor signal;

an analog-to-digital converter configured to convert the analog sensor signal to a digital sensor signal; and

a digital controller configured to receive the digital sensor signal, process the signal and provide an output signal indicating a measured parameter corresponding to the sensor signal.

[c2] 2.The system of claim 1, wherein the digital controller is implemented in a digital signal processor (DSP) and wherein the DSP is embedded in the sensor.

[c3] 3.The system of claim 1, wherein the digital controller is implemented in a microcontroller and wherein the microcontroller is embedded in the sensor.

[c4] 4.The system of claim 1, wherein the sensor comprises a digital capacitance gauge.

[c5] 5.The system of claim 1, wherein the controller utilizes a kernel module which is configured to perform iterations of a control loop, wherein the control loop comprises execution of all of a set of high priority tasks and execution of one or more low priority tasks.

[c6] 6.The system of claim 5, wherein each iteration of the control loop is performed at a periodic time.

[c7] 7.The system of claim 5, wherein the high priority tasks comprise at least one or more of the group consisting of: reading the digital sensor signal from the analog-to-digital converter; calculating a linearized pressure value from the digital sensor signal; writing the linearized pressure value to a digital-to-analog converter; and conveying the linearized pressure value to one or more port buffers.

[c8] 8.The system of claim 5, wherein the low priority tasks comprise at least one or

more of the group consisting of: processing communication messages received from a diagnostics port; processing control area network messages; performing ambient temperature compensation; performing a closed loop heater algorithm; servicing temperature LEDs; monitoring overpressure and zero adjust inputs; servicing status LEDs and switches; servicing an EEPROM; performing an automatic analog scaling procedure; performing an automatic zero adjust procedure; and performing an embedded diagnostic procedure.

[c9] 9.The system of claim 1, wherein the digital controller is configured to perform an automatic calibration procedure.

[c10] 10.The system of claim 1, wherein the digital controller is configured to compute a set of calibration constants upon which linearization calculations are based.

[c11] 11.The system of claim 10, wherein the digital controller is configured to compute the set of calibration constants using a regression procedure.

[c12] 12.The system of claim 10, wherein the digital controller is configured to archive the set of calibration constants in a non-volatile memory.

[c13] 13.The system of claim 9, wherein the digital controller is configured to perform the automatic calibration procedure using calibration data imported to the digital controller from a calibration stand.

[c14] 14.The system of claim 1, wherein the digital controller is configured to perform an automatic zero adjust procedure.

[c15] 15.The system of claim 14, wherein the digital controller is configured to perform the automatic zero adjust procedure in response to an indication from a user.

[c16] 16.The system of claim 14, wherein the digital controller is configured to perform the automatic zero adjust procedure in response to an electronic indication received via a network connection.

[c17] 17.The system of claim 14, wherein the digital controller is configured to

provide control data to an analog zero adjust module, wherein the control data is generated by the automatic zero adjust procedure.

[c18] 18.The system of claim 14, wherein the digital controller is configured to lock out the automatic zero adjust procedure unless a predetermined set of conditions is met.

[c19] 19.The system of claim 18, wherein the predetermined set of conditions include one or more of the group consisting of: inlet pressure being below a detection limit of the sensor; the sensor and its electronics being at a set point temperature; ambient temperature being within a predetermined range; an overpressure signal not being asserted; and no fault conditions existing within the sensor or controller.

[c20] 20.The system of claim 1, wherein the digital controller is configured to perform one or more embedded diagnostic procedures.

[c21] 21.The system of claim 20, wherein the digital controller is configured to provide an indication of a fault condition detected by the one or more embedded diagnostic procedures.

[c22] 22.The system of claim 20, wherein the digital controller is configured to archive detected fault conditions.

[c23] 23.The system of claim 1, wherein the digital controller is configured to transmit diagnostic data resulting from the one or more embedded diagnostic procedures to a diagnostic port.

[c24] 24.The system of claim 1, wherein the digital controller further comprises a dedicated diagnostics port.

[c25] 25.The system of claim 24, wherein internal data stored in the digital controller is accessible to external devices.

[c26] 26.The system of claim 1, wherein the digital controller is configured to linearize the digital sensor signal.

[c27] 27.The system of claim 26, wherein the digital controller is configured to

linearize the digital sensor signal using linearization expressions based on values stored in a non-volatile memory.

[c28] 28.The system of claim 27, wherein the non-volatile memory is an EEPROM.

[c29] 29.The system of claim 1, wherein the digital controller is configured to temperature compensate the digital sensor signal.

[c30] 30.A method for digitally controlling a sensor system comprising:
receiving an analog sensor signal;
converting the analog sensor signal to a digital sensor signal; and
processing the signal to provide an output signal indicating a measured parameter corresponding to the sensor signal.

[c31] 31.The method of claim 30, wherein the method is implemented in a digital signal processor (DSP) and wherein the DSP is embedded in the sensor.

[c32] 32.The method of claim 30, wherein the method is implemented in a microcontroller and wherein the microcontroller is embedded in the sensor.

[c33] 33.The method of claim 30, further comprising producing the sensor signal using a digital capacitance gauge.

[c34] 34.The method of claim 30, further comprising performing iterations of a control loop in a kernel module, wherein the control loop comprises execution of all of a set of high priority tasks and execution of one or more low priority tasks.

[c35] 35.The method of claim 34, further comprising performing each iteration of the control loop at a periodic time.

[c36] 36.The method of claim 34, wherein the high priority tasks comprise at least one or more of the group consisting of: reading the digital sensor signal from the analog-to-digital converter; calculating a linearized pressure value from the digital sensor signal; writing the linearized pressure value to a digital-to-analog converter; and conveying the linearized pressure value to one or more port buffers.

[c37] 37.The method of claim 34, wherein the low priority tasks comprise at least one or more of the group consisting of: processing communication messages received from a diagnostics port; processing control area network messages; performing ambient temperature compensation; performing a closed loop heater algorithm; servicing temperature LEDs; monitoring overpressure and zero adjust inputs; servicing status LEDs and switches; servicing an EEPROM; performing an automatic analog scaling procedure; performing an automatic zero adjust procedure; and performing an embedded diagnostic procedure.

[c38] 38.The method of claim 30, further comprising performing an automatic calibration procedure.

[c39] 39.The method of claim 38, wherein performing the automatic calibration procedure comprises computing a set of calibration constants upon which linearization calculations are based.

[c40] 40.The method of claim 38, wherein computing the set of calibration constants is performed using a regression procedure.

[c41] 41.The method of claim 38, further comprising archiving the set of calibration constants in a non-volatile memory.

[c42] 42.The method of claim 38, further comprising performing the automatic calibration procedure using calibration data imported from a calibration stand.

[c43] 43.The method of claim 30, further comprising performing an automatic zero adjust procedure.

[c44] 44.The method of claim 43, further comprising controlling an analog zero adjust module according to control data generated by the automatic zero adjust procedure.

[c45] 45.The method of claim 43, further comprising locking out the automatic zero adjust procedure unless a predetermined set of conditions is met.

[c46] 46.The method of claim 45, wherein the predetermined set of conditions include one or more of the group consisting of: inlet pressure being below a

zero adjust limit of the sensor; the sensor being at a set point temperature; ambient temperature of the electronics being within a predetermined range; an overpressure signal not being asserted; and no fault conditions existing within the sensor or controller.

[c47] 47.The method of claim 30, further comprising performing one or more embedded diagnostic procedures.

[c48] 48.The method of claim 47, further comprising providing an indication of a fault condition detected by the one or more embedded diagnostic procedures.

[c49] 49.The method of claim 47, further comprising archiving detected fault conditions.

[c50] 50.The method of claim 30, further comprising transmitting diagnostic data resulting from the one or more embedded diagnostic procedures to a diagnostic port.

[c51] 51.The method of claim 30, further comprising linearizing the digital sensor signal.

[c52] 52.The method of claim 51, wherein the digital sensor signal is linearized using linearization expressions based on values stored in a non-volatile memory.

[c53] 53.The method of claim 52, wherein the non-volatile memory is an EEPROM.

[c54] 54.The method of claim 30, further comprising temperature compensating the digital sensor signal.